PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : H04Q 7/38 — A1

(11) International Publication Number: WO 97/34436

(43) International Publication Date: 18 September 1997 (18.09.97)

(21) International Application Number: PCT/SE97/00203

(22) International Filing Date: 11 February 1997 (11.02.97)

(30) Priority Data:
9600962-6 13 March 1996 (13.03.96) SE

(71) Applicant: TELIA AB [SE/SE]; Mårbackagatan 11, S-123 86 Farsta (SE).

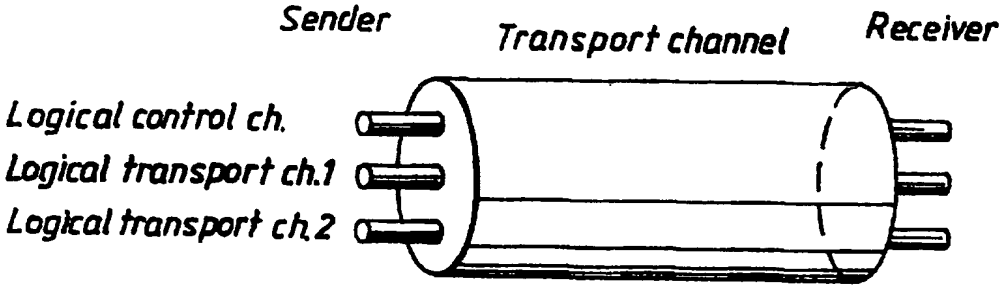
(72) Inventors: LARSSON, Roger; Blidvägen 53, S-976 32 Luleå (SE). ÖSTBERG, Christer; Trossvägen 37, S-973 41 Luleå (SE). WAHLQVIST, Mattias; Klintvägen 231 b, S-973 32 Luleå (SE).

(74) Agent: KARLSSON, Berne; Telia Research AB, Rudsjöterrassen 2, S-136 80 Haninge (SE).

(81) Designated States: NO, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: METHOD AND SYSTEM FOR RADIOTRANSPORT OF DATA



(57) Abstract

The present invention provides a radio system which meets the demand of third generation radio interfaces for greater flexibility and adaptability, by subdividing the radio interface, and its associated functions, into smaller units. Each of these smaller units has a well defined interface with other interface units. A radio communications system, according to the invention, employs a plurality of logical communication channels and has control units for allocating radio resources and for configuring the logical transport channels. Radio transport is effected by means of a plurality of function units, each of which has a function unit specification list associated therewith. The function unit specification lists each include at least two function specifications defining input formats, output formats and signalling, for each function unit. A transport control means is adapted to select a function specification for each function unit from the function unit specification list associated with each function unit.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AM	Armenia	**GB**	United Kingdom	**MW**	Malawi
AT	Austria	**GE**	Georgia	**MX**	Mexico
AU	Australia	**GN**	Guinea	**NE**	Niger
BB	Barbados	**GR**	Greece	**NL**	Netherlands
BE	Belgium	**HU**	Hungary	**NO**	Norway
BF	Burkina Faso	**IE**	Ireland	**NZ**	New Zealand
BG	Bulgaria	**IT**	Italy	**PL**	Poland
BJ	Benin	**JP**	Japan	**PT**	Portugal
BR	Brazil	**KE**	Kenya	**RO**	Romania
BY	Belarus	**KG**	Kyrgystan	**RU**	Russian Federation
CA	Canada	**KP**	Democratic People's Republic of Korea	**SD**	Sudan
CF	Central African Republic			**SE**	Sweden
CG	Congo	**KR**	Republic of Korea	**SG**	Singapore
CH	Switzerland	**KZ**	Kazakhstan	**SI**	Slovenia
CI	Côte d'Ivoire	**LI**	Liechtenstein	**SK**	Slovakia
CM	Cameroon	**LK**	Sri Lanka	**SN**	Senegal
CN	China	**LR**	Liberia	**SZ**	Swaziland
CS	Czechoslovakia	**LT**	Lithuania	**TD**	Chad
CZ	Czech Republic	**LU**	Luxembourg	**TG**	Togo
DE	Germany	**LV**	Latvia	**TJ**	Tajikistan
DK	Denmark	**MC**	Monaco	**TT**	Trinidad and Tobago
EE	Estonia	**MD**	Republic of Moldova	**UA**	Ukraine
ES	Spain	**MG**	Madagascar	**UG**	Uganda
FI	Finland	**ML**	Mali	**US**	United States of America
FR	France	**MN**	Mongolia	**UZ**	Uzbekistan
GA	Gabon	**MR**	Mauritania	**VN**	Viet Nam

METHOD AND SYSTEM FOR RADIOTRANSPORT OF DATA

The present invention relates to a radio communications system, transmitters and receivers therefor and, in particular, the air interface for third generation radio systems such as those used for digital mobile cellular radio telephony.

In second generation radio air interfaces, the object was to design an interface which would support speech transport, together with some data, at a fixed quality of service, over a radio channel, with minimum use of radio resources. By way of contrast, the goal for third generation radio air interfaces is to facilitate the transport of any type of information at a predetermined quality of service over a radio channel with a minimum use of radio resources. Thus, third generation radio air interfaces require a much higher degree of flexibility and adaptability than second generation air interfaces. The present invention proposes a radio system which meets the demand of third generation radio interfaces for greater flexibility and adaptability, by subdividing the radio interface, and its associated functions, into smaller units. Each of these smaller units has a well defined interface with other interface units.

It should be noted that the objectives to be met by third generation air interfaces are not dissimilar to the objectives which are met by ATM, see our co-pending application [Kgp 176/95]. However, while the analogies that can be drawn between third generation radio air interfaces are of considerable value, it should not be forgotten that ATM is employed with systems which, from a radio perspective, have unlimited capacity and extremely high quality of service.

Third generation radio air interfaces will find application with, among other things, digital radio telephony, for example, the DECT system for digital cordless telephony and the GSM system for digital cellular mobile telephony. In such systems, radio communications channels must be established between mobile transceivers and base station transceivers. The present invention is concerned primarily with the transport and control functions of the physical layer and the functions for interleaving and error correction.

The operation of air interfaces used with DECT and GSM systems has been extensively described in prior art literature. In particular, the use of ATM in connection with such systems is also known. However, the present invention is based on a novel approach to the construction/design of third generation radio air interfaces.

US patent 5,406,550 describes a communications system for data transmission from an ATM network to a mobile radio system. The interface between the two systems is arranged to remove the header of each ATM cell entering the radio system from the VPI and VCI. The object of the invention is to reduce transmission overheads.

US patent 5,359,603 describes an ATM system adapted for use with a mobile telecommunications system. The invention is designed to overcome handover problems between base stations associated with slow switching speeds in the fixed network. This invention provides for the establishment of permanent virtual paths across the ATM network which links base stations.

US patent 5,398,347 describes a logical sub-channel scheme which is suitable for use with GSM mobile

systems.

US patent 5,434,859 relates to radio resource management on an FDM mobile radio system which gives access to ATM based services to a subscriber.

PCT patent application WO 93/19559 relates to the interface between ATM over the fixed network and ATM, using half cells, over a mobile network.

According to a first aspect of the present invention, there is provided a radio communications system employing a plurality of logical communication channels having radio resource means for allocating radio resources, transport control means for configuring said plurality of logical transport channels, characterised in that radio transport is effected by a plurality of function units, each of which has a function unit specification list associated therewith, in that said function unit specification lists each include at least two function specifications defining input formats, output formats and signalling, for each function unit, and in that said transport control means is adapted to select a function specification for each function unit from the function unit specification list associated with each function unit.

Operation of said function units may be controlled by parameters transmitted between a transmitter and a receiver.

Control data may be transmitted between a transmitter and a receiver via a physical control channel distinct from said logical communications channels, and said physical control channel may be synchronised with said logical communications channels.

Said physical control channel may carry signals indicative of changes in said parameters.

A transport channel, having a plurality of logical channels associated therewith, may have a separate transport control means, which among other things, sets signalling formats to be used between a transmitter and a receiver, and said radio resource means may be common to all transport channels.

Said radio communications system may include a plurality of fixed base stations and a plurality of mobile stations, and said radio communications system may be adapted to handle three distinct groups of transport channels, namely:

- a minimum group comprising transport channels supported by all base stations in said radio communications system;

- a standardised group comprising transport channels the specifications of which are built into some of said base stations; and

- an open group comprising transport channels specified during system operation.

Said radio communications system may include transceivers having means for downloading software modules required to support a transport channel falling within said open group of transport channels.

Said radio communications system may be a digital cellular mobile radio telephony system.

Said radio system may be a GSM digital cellular mobile radio telephony system.

Alternatively, said radio system may be a DECT mobile radio telephony system.

According to a second aspect of the present invention, there is provided a base station characterised in that said base station forms part of a radio communications system as defined above.

According to a third aspect of the present invention, there is provided a mobile transceiver characterised in that said mobile transceiver is adapted to operate within a radio communications system as defined above.

According to a fourth aspect of the present invention, there is provided, in a radio communications system employing a plurality of logical communication channels having radio resource means for allocating radio resources, transport control means for configuring said plurality of logical transport channels, a method of controlling radio communication between two transceivers characterised by:

- effecting radio transport of data by means of a plurality of function units each of which can operate in at least two different modes, each mode defined by a function specification; and

- selecting, for each function unit, a mode of operation, by means of a handshake procedure conducted between said two transceivers.

Said function units may include multiplexing, coding and/or interleaving, modulation, multiple access, and radio transmission.

Preferably, said function units have well defined interfaces with each other.

Preferably, each function specification defines four interfaces, namely:

- input transport, defining a data format for data to be transmitted to an input to a function unit;
- output transport, defining a data format for data to be transmitted from an output of a function unit;
- input control, defining a format for control signalling required by a function unit; and
- output control, defining a format for signalling produced by a function unit.

Said method may include:

- passing parameters between said two transceivers; and
- controlling operation of said function units in dependence on the value of said parameters.

One of said parameters may be a measure of quality of reception at a receiving transceiver.

Each function unit may have associated therewith a function unit specification list defining the function specifications for the different modes of operation which that function unit can perform.

Said method may include selecting, on setting up a

radio communication link, a function specification, together with a set of initial parameters, for each function unit.

Said method may include:

- transmitting control data between two transceivers via a physical control channel distinct from logical communications channels used for transmission of subscriber data; and
- synchronising said physical control channel with said logical communications channels.

Said logical communications channels may fall into one of three distinct groups of transport channels, namely:

- a minimum group comprising transport channels supported by all transceivers in said radio communications system;
- a standardised group comprising transport channels the specification of which are built into some of said transceivers; and
- an open group comprising transport channels specified during system operation.

A transceiver, as part of a communications link set up procedure, may download software modules required to support a transport channel falling within said open group of transport channels.

Embodiments of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 illustrates, in schematic form, the relationship between a transport channel and logical channels;

Figure 2 illustrates the operation of radio resource control and transport control on the radio transport service provided by a radio communications system according to the present invention;

Figure 3 illustrates the grouping of transport channels in the present invention;

Figure 4 is flow diagram of the process used to set up a transport channel;

Figure 5 is a representation of the transport chain used in the present invention;

Figure 6 illustrates the selection of a functional specification and the interfaces between functional units established thereby;

Figure 7 illustrates the operation of control functions on transport channels.

To facilitate an understanding of the present invention a glossary of the abbreviations used in the specification is set out below:

ACA: Access Channel Allocation

ATM: Asynchronous Transfer Mode

BS: Base Station

ATM: Asynchronous Transfer Mode

FH: Frequency Hopping

FS: Function Specification

FU: Function Unit

FUSL: Function Unit Specification List

IC: Input Control

IT: Input Transport

MS: Mobile Station

OC: Output Control

OFDM: Orthogonal Frequency Division Multiplex

OT: Output Transport

QoS: Quality of Service

RTF: Radio Transport Function

VC: Virtual Channel

VCI: Virtual Channel Identifier

VP: Virtual Path

VPI: Virtual Path Identifier

Data is transmitted, in a radio transmission system, from a sender to a receiver by means of a radio transport service. The radio transport service can be regarded as part of a radio transport function which includes functions for the allocation of radio resources

and functions for handling routing etc.. The attributes of a radio transport service are used, in conjunction with the resource allocation function, to select a transport channel. A transport channel can consist of one, or many, logical channels, see Figure 1, which schematically represents a single transport channel having two logical channels for the transmission of subscriber data and a logical control channel for system signalling and transmission of system data. A transport channel is treated as a single connection when it comes to handover, and similar functions, related to the mobile radio telephony environment. The use of transport channels can be compared to VC and VP in ATM.

There is a clear distinction between the way logical channels used for control and logical channels used for transport of subscriber information are handled. As can be clearly seen from Figure 2, the logical channels used for transport of subscriber data are input into the radio transport chain, whereas the logical channels used for control are passed to the transport control functions. The transport control function configures the logical transport channel by selection of function specifications and parameter settings for each function unit, see below. Information on the selected function specifications and associated parameter settings is passed to a receiver by means of a physical control channel. The physical control channel must be synchronised with the logical transport channels with which it is associated. This is a necessary requirement because the physical control channel is used for transmission of data relating to changes in parameter settings applicable to an active transport channel.

The control functions, see Figure 2, can be divided into two groups, the transport control sub-system and

resource control sub-system. Each transport channel has a transport control sub-system that defines how signalling between sender and receiver should be performed. There is a resource control sub-system which is common to all transport channels in the system and which allocates radio resources. Typical resource control functions are: ACA, frequency hoping, power control and subcarrier allocation.

A transport channel can operate in three distinct modes, namely: set up, active, and release. In the set up mode a function specification is selected for each unit in the transport chain. The selection is achieved by using the set up channel, together with a preset protocol for this channel. During the active mode, subscriber data is transmitted over the transport chain. The control functions must, while the system is in the active mode, maintain quality of service and support variations in the radio transport service, using the minimum of radio resources. This is achieved by changing the parameters associated with each function specification. A transport channel is released when it is disconnected, or handed over to another base station.

It is possible to have a number of different types of transport channel, as illustrated schematically in Figure 3. In particular, transport channels can be classified into three sets, namely: minimum, standardised and open. The minimum set of transport channels are those transport channels which are supported by all base stations and mobiles in the system. The standardised set are those transport channels, not falling in the set of minimum transport channels, that are available when the system was first commissioned. In other words, some, but not all, mobiles and base stations will be able to support transport channels in the standardised set. The last

set of transport channels, the open set, are transport channels which can be used to expand the capabilities of the system after it has been commissioned.

Figure 4 is a flow diagram illustrating the method by which a transport channel is set up. Initially, the set up channel is activated. The set up channel is then used for signalling between the transmitter and receiver. The signalling procedures vary, depending on the set (minimum, standard, or open) to which the radio transport channel belongs. To set up a transport channel belonging to the minimum set, a minimum of signalling is required, because, all BS/MS in the system support this set of transport channels. For transport channels belonging to the standardised set, the function specification to be used by each of the function units is selected and the initial parameter settings determined. With transport channels belonging to the open set, there are two possibilities, either the terminal already supports the transport channel, or the terminal is an advanced multimode terminal that can download software to support the selected transport channel.

After the set up phase, the transport channel is in active mode. In the active mode, the object is to maintain quality of service and to adapt the transport channel to changes in the attributes, or environment, of the radio service. This is achieved by passing parameters, supported by the function specifications, between the sender and receiver. Typical parameters transmitted by the receiver are various quality of service measurements, e.g. received power, error rate, etc.. These parameters are analysed at the transmitter and the results used to update parameter settings in the functional specifications of the function units in both transmitter and receiver.

Subscriber data is transmitted over the transport channels. A transport channel can be regarded as a specific selection of function specifications in the transport chain. Operation of the transport control sub-system is schematically illustrated in Figure 5. It will be noted that the transport control sub-system is divided into a number of function units. Typical function units are multiplexing, coding/interleaving, modulation, multiple access and transmitter operation. Each function unit has an associated function unit specification list which defines the set of possible function specifications for the function unit. Each function specification is a detailed description of the input format and output format of the transport and control information. In other words, a function specification defines a possible mode of operation for a function unit in terms of inputs and outputs. There are two sections in a function specification list, a section that deals with standardised functions and a section that deals with the open set of transport channels.

When a function unit is set up, a function specification, available on the function specification list for that function unit, is selected. This function specification will then define the interfaces and functions of the function unit. A function specification defines four interfaces:

- input transport;
- output transport;
- input control ; and
- output control.

This process is illustrated in Figure 6, which shows the relationship between a function unit, its function specification list and function specifications. Figure 6 shows that FS_1 has been selected and that the inputs and outputs of the function unit are now dictated by FS_1. Thus, it will be seen that a transport channel can be regarded as the combination of the function specifications for each of the function units in the radio transport chain. When the transport channel is in the active phase, the input control and output control interfaces are used to change parameters in the function specification, i.e. to modify operation of the radio transport chain to meet current radio environment constraints and attributes.

By using function units, the physical layer is divided into smaller units with well defined interfaces between units. Smaller units are needed to meet the requirement, with third generation radio air interfaces, for flexibility and adaptability in the physical layer.

The control function can be divided into the transport control function and the resource control function. The transport control function is unique for each transport channel type. The resource control function contains functions that allocate radio resources for all transport channels. Typical examples of functions controlled by the resource control are ACA, FH and subcarrier allocation. The relationship between resource control functions, transport control functions and transport channels is illustrated schematically in Figure 7. Information transmitted to the transport control function is conveyed over a logical channel. A typical example of a logical channel used for control, is the associated control channel. The resource control has an interface towards the resource control functions in higher layers. The resource control uses functions

in the transport control domain to send information between the sender and receiver. The protocol used for transmission of control information on the associated control channel depends on the importance of the control information to be transmitted over that channel.

Referring again to Figure 5, information transported by the transport chain has to be in the format specified for the transport channel. The input format depends on which function specification has been selected. For example, the multiplexing unit combines information from different logical channels. The way in which the multiplexing operation is performed depends on the type of transport channel used, since the requirements for different transport channels differ. The multiplexed data is mapped onto transmission symbols by the modulation unit. The framing unit combines the transport information with the control information used to configure the radio transport chain. The power control unit sets the power on each of the access channels. The multiple access unit combines different access channels and converts them into a baseband channel. Finally the base band channel is transmitted on a physical channel.

CLAIMS

1. A radio communications system employing a plurality of logical communication channels having radio resource means for allocating radio resources, transport control means for configuring said plurality of logical transport channels, characterised in that radio transport is effected by a plurality of function units, each of which has a function unit specification list associated therewith, in that said function unit specification lists each include at least two function specifications defining input formats, output formats and signalling, for each function unit, and in that said transport control means is adapted to select a function specification for each function unit from the function unit specification list associated with each function unit.

2. A radio communications system as claimed in claim 1, characterised in that said function units include multiplexing, coding and/or interleaving, modulation, multiple access, and radio transmission.

3. A radio communications system as claimed in either claim 1, or 2, characterised in that said function units have well defined interfaces with each other.

4. A radio communications system as claimed in claim 3, characterised in that each function specification defines four interfaces, namely:

- input transport, defining a data format for data at an input to a function unit;

- output transport, defining a data format for data at an output of a function unit;

- input control, defining a format for control signalling required by a function unit; and

- output control, defining a format for signalling produced by a function unit.

5. A radio communications system as claimed in any previous claim, characterised in that operation of said function units is controlled by parameters transmitted between a transmitter and a receiver.

6. A radio communications system as claimed in any previous claim, characterised in that control data is transmitted between a transmitter and a receiver via a physical control channel distinct from said logical communications channels, and in that said physical control channel is synchronised with said logical communications channels.

7. A radio communications system as claimed in claim 6, characterised in that said physical control channel carries signals indicative of changes in said parameters.

8. A radio communications system as claimed in any previous claim characterised in that a transport channel, having a plurality of logical channels associated therewith, has a separate transport control means, which among other things, sets signalling formats to be used between a transmitter and a receiver, and in that said radio resource means is common to all transport channels.

9. A radio communications system as claimed in claim 8, characterised in that said radio communications system includes a plurality of fixed base stations and a plurality of mobile stations, and in that said radio

communications system is adapted to handle three distinct groups of transport channels, namely:

- a minimum group comprising transport channels supported by all base stations in said radio communications system;

- a standardised group comprising transport channels the specifications of which are built into some of said base stations; and

- an open group comprising transport channels specified during system operation.

10. A radio communications system as claimed in claim 9, characterised in that said radio communications system includes transceivers having means for downloading software modules required to support a transport channel falling within said open group of transport channels.

11. A radio communications system as claimed in any previous claim characterised in that said radio communications system is a digital cellular mobile radio telephony system.

12. A radio communications system as claimed in claim 11, characterised in that said radio system is a GSM digital cellular mobile radio telephony system.

13. A radio communications system as claimed in any of claims 1 to 10, characterised in that said radio system is a DECT mobile radio telephony system.

14. A base station characterised in that said base station forms part of a radio communications system as claimed in any of claims 11 to 13.

15. A mobile transceiver characterised in that said mobile transceiver is adapted to operate within a radio communications system as claimed in any of claims 11 to 13.

16. In a radio communications system employing a plurality of logical communication channels having radio resource means for allocating radio resources, transport control means for configuring said plurality of logical transport channels, a method of controlling radio communication between two transceivers characterised by:

- effecting radio transport of data by means of a plurality of function units each of which can operate in at least two different modes, each mode defined by a function specification; and

- selecting, for each function unit, a mode of operation, by means of a handshake procedure conducted between said two transceivers.

17. A method as claimed in claim 16, characterised in that said function units include multiplexing, coding and/or interleaving, modulation, multiple access, and radio transmission.

18. A method as claimed in either claim 15, or 16, characterised in that said function units have well defined interfaces with each other.

19. A method as claimed in claim 18, characterised in that each function specification defines four interfaces, namely:

- input transport, defining a data format for data to be transmitted to an input to a

function unit;

- output transport, defining a data format for data to be transmitted from an output of a function unit;

- input control, defining a format for control signalling required by a function unit; and

- output control, defining a format for signalling produced by a function unit.

20. A method as claimed in any of claims 16 to 19, characterised by:

- passing parameters between said two transceivers; and

- controlling operation of said function units in dependence on the value of said parameters.

21. A method as claimed in claim 20, characterised in that one of said parameters is a measure of quality of reception at a receiving transceiver.

22. A method as claimed in either claim 20, or 21, characterised in that each function unit has associated therewith a function unit specification list defining the function specifications for the different modes of operation which that function unit can perform.

23. A method as claimed in claim 22, characterised by selecting, on setting up a radio communication link, a function specification, together with a set of initial parameters, for each function unit.

24. A method as claimed in any of claims 16 to 23,

characterised by:

- transmitting control data between two transceivers via a physical control channel distinct from logical communications channels used for transmission of subscriber data; and

- synchronising said physical control channel with said logical communications channels.

25. A method as claimed in claim 24, characterised in that said logical communications channels fall into one of three distinct groups of transport channels, namely:

- a minimum group comprising transport channels supported by all transceivers in said radio communications system;

- a standardised group comprising transport channels the specification of which are built into some of said transceivers; and

- an open group comprising transport channels specified during system operation.

26. A method as claimed in claim 25, characterised by a transceiver, as part of a communications link set up procedure, downloading software modules required to support a transport channel falling within said open group of transport channels.

27. A method as claimed in any of claims 16 to 26, characterised in that said radio communications system is a digital cellular mobile radio telephony system.

28. A method as claimed in claim 27, characterised in that said radio system is a GSM digital cellular mobile

radio telephony system.

29. A method as claimed in any of claims 16 to 26, characterised in that said radio system is a DECT mobile radio telephony system.

Fig. 1

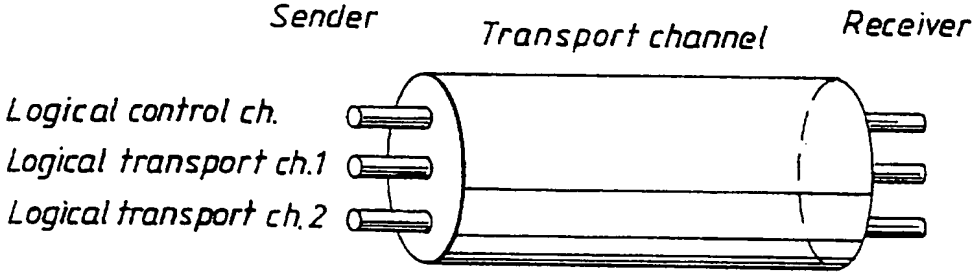


Fig. 2

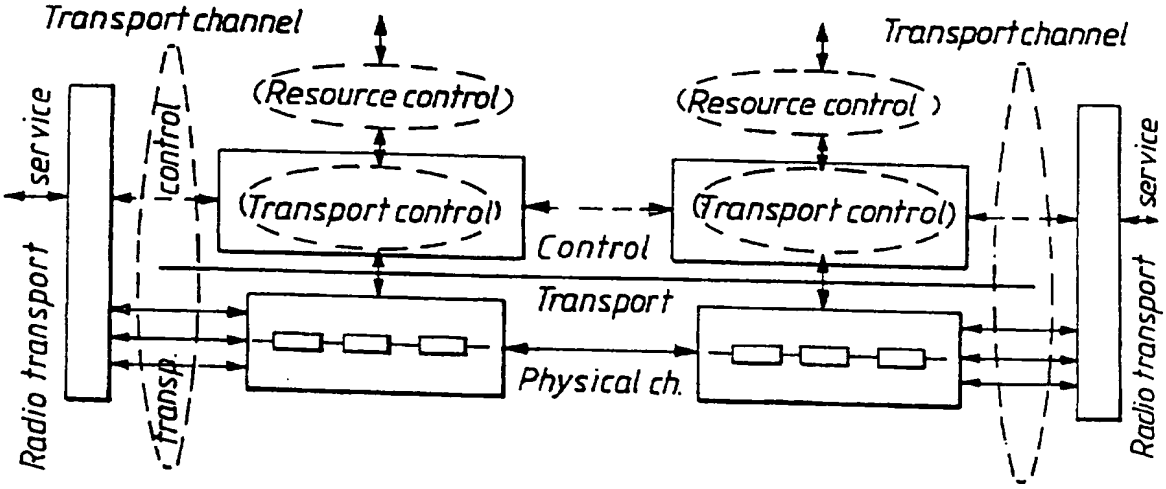


Fig. 3

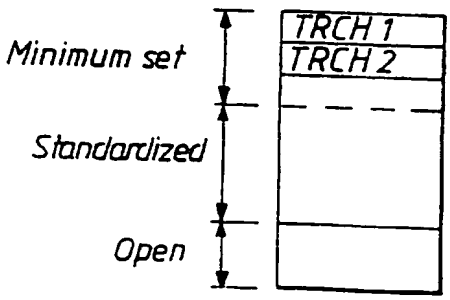


Fig. 4

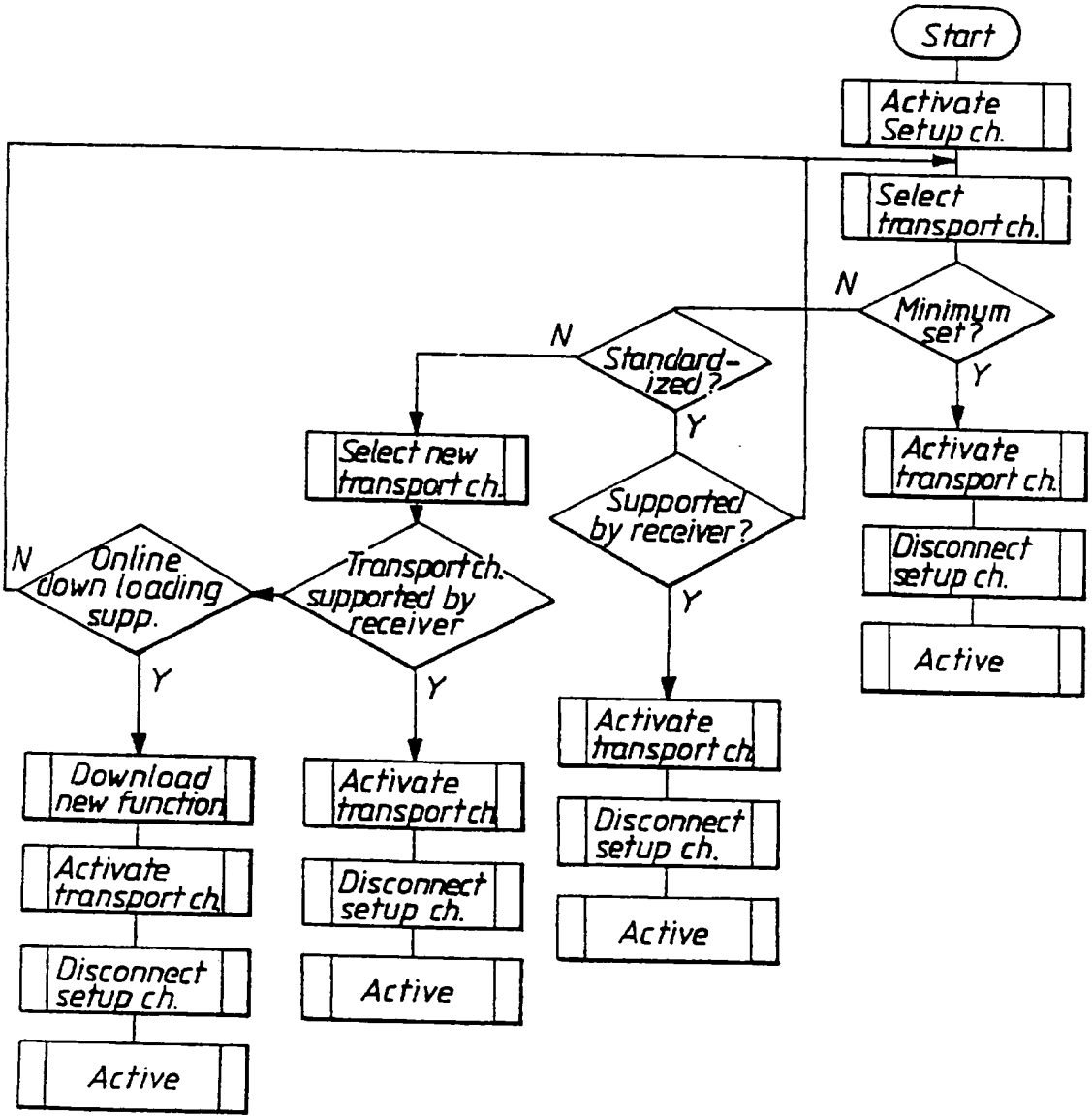

Start
Activate Setup ch.
Select transport ch.
Minimum set?
N
Y
Standard-ized?
N
Y
Supported by receiver?
Y
Activate transport ch.
Disconnect setup ch.
Active
Select new transport ch.
Transport ch. supported by receiver
Y
Online down loading supp.
N
Y
Activate transport ch.
Disconnect setup ch.
Active
Download new function
Activate transport ch.
Disconnect setup ch.
Active

Fig. 5

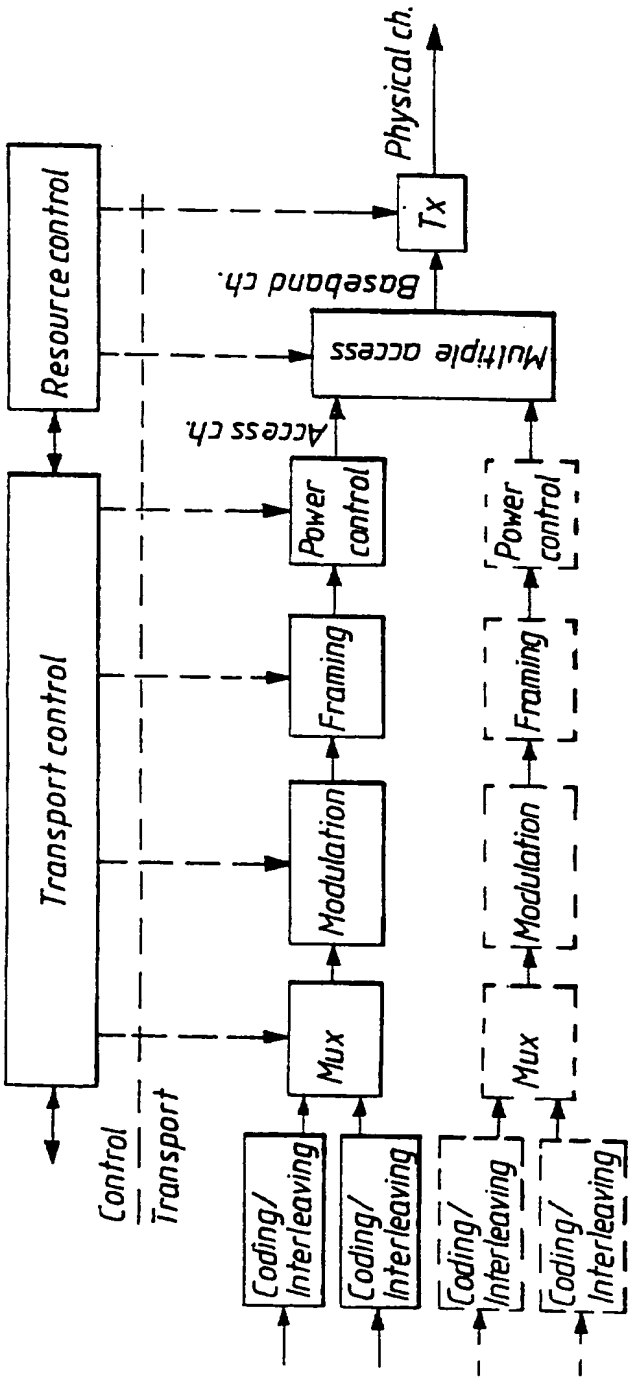

Physical ch.
Tx
Baseband ch.
Multiple access
Access ch.
Resource control
Transport control
Power control
Framing
Modulation
Mux
Coding/ Interleaving
Control
Transport

Fig. 6

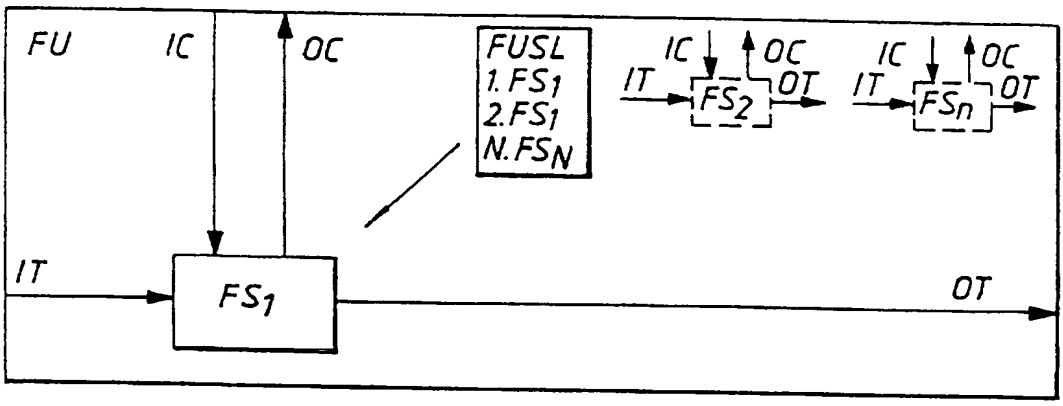
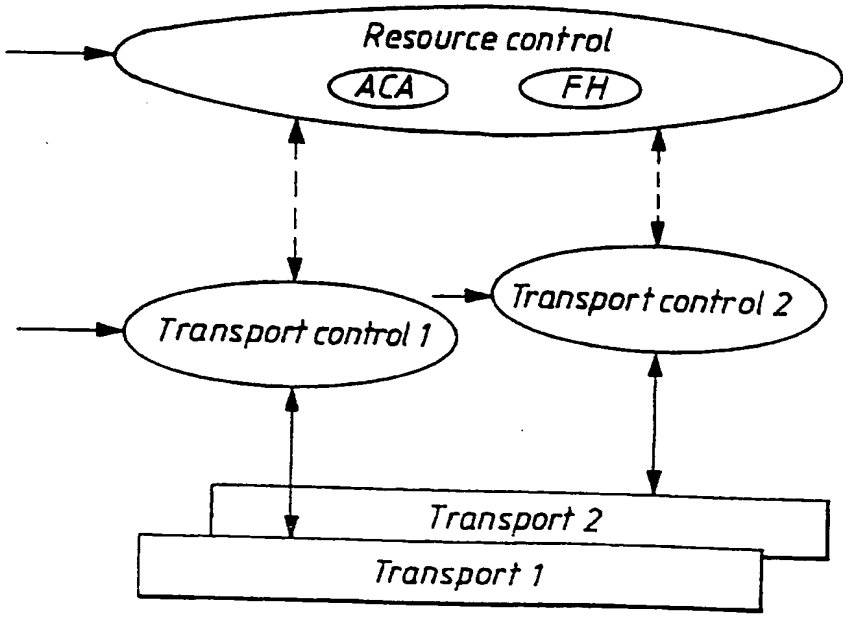

FU
IC
OC
FUSL
1. FS1
2. FS1
N. FSN
IC
OC
IT
FS2
OT
IC
OC
IT
FSn
OT
IT
FS1
OT

Fig. 7


Resource control
ACA
FH
Transport control 1
Transport control 2
Transport 2
Transport 1

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 97/00203

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H04Q 7/38
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification, system followed by classification symbols)

IPC6: H04Q, H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0681406 A1 (NOKIA MOBILE PHONES LTD.), 8 November 1995 (08.11.95), column 1, line 49 - column 2, line 26; column 3, line 42 - line 51; column 5, line 2 - line 14	1-15

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"B" erlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
21 August 1997	25 -08- 1997
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Peter Hedman Telephone No. +46 8 782 25 00

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

06/08/97

International application No.
PCT/SE 97/00203

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0681406 A1	08/11/95	AU 1785795 A	09/11/95
		CN 1112346 A	22/11/95
		FI 98426 B,C	28/02/97
		FI 942038 A	04/11/95
		US 5640395 A	17/06/97